**Name: Toindepi Graciano Zihori Date:14/08/12**

**Task 3**

**Smart Grid - Sustainability at Work**

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**A smart grid** is an electrical grid that uses computers and other technology to gather and act on information, such as information about the behaviors of suppliers and consumers, in an automated fashion to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity.

Smart Grid

● It involve the overlaying of a network metering system over existing

electrical grid. Included in this network metering system are a range of

smart devices including smart meters.

● New generation meters, relays and circuit breakers provide the

measurement and control and allow two way communication to

electricity production, transmission, distribution and consumption

**Smart Grid**

<http://en.wikipedia.org/wiki/Smart_grid>

**Theory**

Research the PowerUSB Controlled Power Board at:

<http://www.pwrusb.com/featuresandbenefits.html>

Check and advise the following:

Voltage Rating: V AC

Total Current Rating: A

Single Outlet Current Rating: A

Individual Outlet Fuse: A

Power Cable Length: m

USB Cable Length: m

Answer the following questions:

Q: Does the PowerUSB comply with Electrical Safety Standards?

A: Yes

Q: How is the equipment turned on and off?

* One Always On
* Three controlled via USB or Switch

Q: How many pieces of computer peripheral equipment can connect to the PowerUSB?

* : Four separate outlets

Q: What is the procedure for a piece of equipment such as fax machine that needs to be on standby or not to be switched off?

A: Plug it into the Always powered on socket.

Q: What are the features for controlling a printer?

* Automatically switches on the printer during printing
* Large power saving if printer is used occasionally and when not in use
* Printer is kept powered down or on standby thus increasing life of the printer thereby reducing power consumption also

Q: What are the software features for controlling power outlets?

* Multiple OS support, MAC OSX, Linux, Windows,
* Customizable programmable global hot keys,
* Monitor routers for hangups.

Q: What are some other applications of the PowerUSB?

* High surge suppression best for industry
* programmable and usable for personal home use
* Power switch with built in fuse

**Practicum**

Install the programmable PowerUSB power board software on a PC

Step 1:

Obtain the CD or download the software from:

<http://smartgridresources.wikispaces.com/>

Step 2:

START APPLICATION

Run the Software by double clicking the PowerUSB icon



or from the Windows Start menu under Power USB group



Step 3:

SOFTWARE INTERFACE



The outlets can be powered on by selecting the check box for “Power Outlet 1” and “Power Outlet 2”.

The outlets can also be toggled (‘on’ to ‘off’ or vice versa) by shortcut keys. The shortcut keys for switching on/off (toggle) outlet 1 and 2 are:

Outlet 1: Simultaneously pressing Control – Shift and P key

Outlet 2: Simultaneously pressing Control – Shift and A key.

These shortcut keys will work even when the application is minimized and running in the background

Step 4:

ADVANCED OPTIONS

Clicking the Advanced button will open the Advanced Options dialog.



The Outlet1 and 2 Default state will set the default state of the outlets when connected to a computer (even without the PowerUSB control software running). When set to ‘On’, the outlets will turn ‘on’ when connected to computer and turn ‘off’ when disconnected from computer.

Step 5:

EXITING THE APPLICATION

The application can be exited (quit) only from the system tray. When minimized it will be running in the background in system tray. Right click on the leaf in the system tray and select Exit. **Once quit, the power outlets will be in the previous state**.

Step 6:

**CONNECTING DEVICES - WARNING**

Connect devices such as a monitor, printer, scanner, active speakers and lamp into the 2 outlets marked 'Port 1' and 'Port 2' on the power board **when the PowerUSB complies with Electrical Safety Standards**.

Step 7:

CONTROLLING FROM THIRD PARTY APPLICATIONS

The PowerUSB can be controlled from third party applications through functions calls provided in the DLL.

The DLL provides functions to initialize the PowerUSB and set the outlet power states. The DLL can be loaded statically or dynamically from the calling application.

The DLLs have been tested under Visual Studio .Net and VC++ 6.0 in Windows XP and Windows 7 environments.

*Initialization*

Initializes the Power USB API.

No other functions can be called till the API is initialized.

Name: InitPowerUSB

Parameters: None

Return: >=0 if successful. < 0 on failure

C++ Example:

if (!m\_pwrUSBInit)

{

if (InitPowerUSB() >= 0)

{

m\_pwrUSBInit = 1;

m\_pwrUsbConnected = CheckStatusPowereUSB();

}

}

*Check PowerUSB connectivity*

Checks to see if the power USB is connected to the computer. Returns the number of Power USBs connected.

Windows function OnDeviceChange can be used to monitor the connection/disconnection of the powerUSB dynamically.

Name: CheckStatusPowereUSB

Parameters: None

Returns: Number of PowerUSB devices connected

C++ Example:

BOOL CPowerUSBDlg::OnDeviceChange(UINT nEventType, DWORD\_PTR dwData)

{

m\_pwrUsbConnected = CheckStatusPowereUSB();

UpdateData(TRUE);

if (m\_pwrUsbConnected)

m\_connectionStr = "PwrUSB Connected";

else

m\_connectionStr = "PwrUSB Not Connected";

UpdateData(FALSE);

return TRUE;

}

*Close the Device*

Closes the PowerUSB API. Should be called in application exit function such as OnDestroy.

Name: ClosePowerUSB

Parameters: None

Returns: >=0 if successful. < 0 on failure

C++ Example:

if (m\_pwrUSBInit)

{

ClosePowerUSB();

m\_pwrUSBInit = 0;

}

*Set the Outlet State*

Sets the power on/off state of the two outlets.

Name: SetPortPowerUSB

Parameters: int port1, int port2. (0=switch off the power, 1=switch on the power)

Returns: >=0 if successful. < 0 on failure

C++ Example:

m\_port1 = 0;

m\_port2 = 1;

SetPortPowerUSB(m\_port1, m\_port2);

*Set the Default power up state*

Sets the default power up state of the Power USB (when connected to Computer). If set to 1, the outlet will come on when the attached computer is booted up.

Name: SetDefaultStatePowerUSB

Parameters: int port1, int port2. (0=default off state, 1=default on state)

Returns: >=0 if successful. < 0 on failure

C++ Example:

SetDefaultStatePowerUSB(m\_defaultState1,.m\_defaultState2);

Step 8

TESTING APPLICATIONS

Test the applications.

Tick if applications are successful:

Initialization Yes

Check PowerUSB connectivity Yes

Close the Device Yes

Set the Outlet State Yes

Set the Default power up state Yes

**Summary**

The ability to control the power in outlets through provided software also makes the PowerUSB a home or commercial automation device.

Questions

1: Explain how lights or any devices can be switched ‘on’ remotely or through timed software applications using this device:

Scripts running on a computer at home or from a remote computer can be programmed to run at certain times

With the introduction of apps these can be installed on a smart phone to run at anytime from anywhere

Some remote management software can be used to turn devices air conditioners on or off at certain time whether people are at home or not

2: Explain how the PowerUSB-C detects and restores computers automatically when they 'hang up':

When the computer is working the PowerUSB-C receives messages called “service pulses” indicating that it on and running.The PowerUSB-C automatically initiate power recycling in the process powers on or off the computer thus reducing both power consumption and power surge or spikes

Resources

Components - PowerUSB Controlled Power Board

<http://www.pwrusb.com/products.html>

Research USB controlled power outlets at:

<http://www.google.com.au/#hl=en&q=usb+controlled+power+outlet&revid=1332163496&sa=X&ei=6M9oTceyCsejcZ_yiI8M&ved=0CIUBENUCKAY&fp=190c8307a70ec87c>